



TECHNICAL DESCRIPTION

DED-163/05.04.2024

Single-Pole Shunt for Insulated LV Bundle Conductors of 3 X 70 mm<sup>2</sup> Al + 54,6 mm<sup>2</sup> AAAC + 25 mm<sup>2</sup> Al or 4 X 120 mm<sup>2</sup> Al + 25 mm<sup>2</sup> Al cross-section

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**Single-Pole Shunt for Insulated LV Bundle Conductors of 3 X 70 mm<sup>2</sup> Al + 54,6 mm<sup>2</sup> AAAC + 25 mm<sup>2</sup> Al or 4 X 120 mm<sup>2</sup> Al + 25 mm<sup>2</sup> Al cross-section**

## 1. SCOPE

This description determines the technical requirements, packing instructions and acceptance tests for the single-pole shunt for 3 X 70 mm<sup>2</sup> Al + 54,6 mm<sup>2</sup> AAAC + 25 mm<sup>2</sup> Al or 4 X 120 mm<sup>2</sup> Al + 25 mm<sup>2</sup> Al insulated LV bundle conductors, which shall hereafter be called "shunt" for reasons of simplicity. The shunt is used for the temporary connection of LV insulated overhead lines. The equipment connects the connector heads of phases, neutral and municipal lighting.

## 2. KEY WORDS

Single-pole shunt, Insulated Socket, Flexible single-pole cable, Insulated LV overhead line of 4 X 120 mm<sup>2</sup> Al + 25 mm<sup>2</sup> Al cross-section or 3 X 70 mm<sup>2</sup> Al + 54,6 mm<sup>2</sup> AAAC + 25 mm<sup>2</sup> Al cross-section, 400 V.

## 3. OPERATING CONDITIONS

### 3.1. Ambient conditions

#### - Installation

The shunt shall be used shall be suitable for outdoor use on networks of insulated LV overhead bundle conductors even during rainfall. In case it is not in use, it shall be stowed in vehicle storage compartments or in HEDNO warehouses. Until its first use, it shall be stored in suitable warehouses.

#### - Ambient conditions

The ambient conditions for operation and storage shall be the following:

- Maximum ambient air temperature 40°C with a mean value measured over a period of 24 hours which shall not exceed 35°C.
- Minimum ambient air temperature: -20°C.
- Humidity: between 20% and 96%.
- Special conditions: The shunt shall be suitable for work under the following environment conditions: powdery/salt/industrial deposits, presence of condensation/rain/frost.

### 3.2. Electrical system characteristics

The shunt shall be used on LV three phase systems 50 Hz, 400 V (line to line), where direct (TT) or neutral earthing (TN) is applied (according to IEC 60364).

#### 4. STANDARDS AND SPECIFICATIONS - DEFINITIONS

In the present description, the following codes and standards have been considered:

- PPC Technical Specification GR-324/24.7.86 "Branch and delivery connectors for networks of insulated LV overhead bundle conductors".
- Technical Specification NF C 33-020/Juillet 1994 "Connecteurs de dérivation à perforation d'isolant pour réseaux et branchements aériens de tension assignée 0,6/1 kV en conducteurs isolés torsadés".
- PPC Technical Description no. TK 02.01/11.11.87 "Sampling plans and procedures for inspection by attributes".
- PPC Technical Description ΔΜΚΛΔ-153/14.09.95 " Connector heads for networks of insulated LV overhead bundle conductors".

#### 5. DESCRIPTION

##### 5.1. General description

The equipment shall consist of two fully insulated sockets interconnected by a flexible single-pole cable. The sockets mentioned above shall interlock to the connector heads (PPC Technical Description ΔΜΚΛΔ-153) which are permanently installed on the conductors on each side of dead-end structures of LV insulated overhead lines. The shunt joins connector heads of the same phase or neutral or Municipal lighting respectively. For each dead-end structure four or five shunts are required.

##### 5.2. Socket

The shunt socket shall be made of brass or other equivalent oxidation and corrosion resistant material. It shall be suitably designed to be fully inserted and interlock with the plug of the connector head. Its dimensions shall be well-matched with the dimensions of the plug of the connector head. The dimensions of the plug of the connector head are the ones determined by drawing 9.1 of the present description. The socket shall be suitably designed in order to interlock to the points of the above plug via a bayonet mechanism. The internal surface of the socket shall be suitably designed so that reliable electrical contact of the socket to the plug of the connector head can be achieved, by means of spring type tension (i.e. spring-contact onto the internal surface of the socket). The dimensions of the socket and its insulated sleeve shall be the ones determined by drawing 9.2 of the present description.

##### 5.3. Insulating sleeve

The insulating sleeve of the socket shall cover both the socket and the terminal of the single-pole cable. The insulating sleeve of the socket snaps to the internal surface of the insulating sleeve of the connector head, replacing its removable plastic cap. The internal diameter of the insulating sleeve of the plug of the connector head is 24 mm. The insulating sleeve shall be made of a synthetic material, suitable and resistant to outdoor use, sun's ultra-violet radiation and generally to the following environmental conditions (exposition to sun, ultra-violet radiation, powdery or salt or industrial deposits, presence of condensation, low ambient temperatures of -10°C etc), for its entire service life (see paragraph 5.6).



Duly noting that this statement does not constitute an obligation on either side (Supplier or HEDNO respectively), the following materials (commercial names are quoted) have been used on our network and have performed well :

PVC

THERMOPLASTIQUE VINILIQUE

CAOUTCHOUC NITRILE ACRULIQUE + PVC

MELANGE HYPALON NEOPRENE

#### 5.4. Flexible single-pole cable

The two sockets of each shunt shall be interconnected by a flexible single-pole copper (Cu) multi-strand cable, class 6 (according to EN 60228), of at least 50 mm<sup>2</sup> cross-section and 1,50-1,80 m length. The insulation of the cable shall be of transparent PVC or any other equivalent insulating material. The fitting of the cable to the terminals of the sockets shall be screw type or press type.

#### 5.5. Electrical requirements

- Short circuit withstand current : 3600 Amps for 1 sec

- Dielectric strength : 6 kV (r.m.s, 50 Hz), 1 min at 20°C

#### 5.6 Service life requirements

The shunt shall be able to operate satisfactorily for a period of 10 years at least. During its anticipated service life, at least 3000 operations (shuntings) should be performed successfully and safely.

#### 5.7 Suitability for live line work

The shunt shall be suitable for dead or live line work. It is understood that its use shall be simple, easy and safe during live line work.

#### 5.8 Impermeability

The impermeability of the system "insulating sleeve of the shunt socket - insulating sleeve of the plug of connector head" shall be equivalent to the one of the system "insulating sleeve of the plug of connector head - removable plastic cap of this plug" in order to avoid humidity penetration.

#### 5.9 Robustness of the material

The manufacturing of the shunt shall be robust and its bayonet latching system shall operate successfully during its whole service life so that the equipment shall perform in ambient conditions and under vibrations due to wind. Moreover the shunt shall be capable to resist hard use during its assembling with the connectors heads under muscular stress applied by the lineman. The insulating sleeves shall also operate successfully during their whole service life.



#### 5.10 Anti-corrosion surface protection

The protection against oxidation and corrosion of the metallic surfaces shall be assured under the conditions of outdoor use, during its whole service life. All steel surfaces must be zinc plated. All brass surfaces must be tin plated.

### 6. TESTS

#### 6.1 Type tests

Type tests shall be carried out at the beginning of the Contract, and it is possible to be repeated whenever needed by HEDNO during Contract execution.

At HEDNO's discretion there is the possibility of acceptance of type tests certificates, issued by test laboratories accredited by any public or private independent accreditation body.

The type tests are the following:

##### 6.1.1 Robustness test

To check the robustness of the shunt and especially the robustness of the latching system with the connectors heads as well as the robustness of the insulating sleeves of the sockets, on each specimen of the sample mentioned below, 300 operations of connection-disconnection on the connector heads are carried out under muscular stress conditions of the operator. A number of 3 specimens is taken for this test.

Connector heads of the size 1 (25 mm<sup>2</sup>) or size 2 (35-70 mm<sup>2</sup>) or size 3 (120 mm<sup>2</sup>) shall be used. After handling, no part or section of the specimens should be damaged and the required force of disconnection, measured by means of a dynamometer, shall not be less than 25 N.

##### 6.1.2. Impermeability and Dielectric strength test

The test is carried out on a system "connector head - shunt - connector head". The 2 connector heads shall be connected to a piece of LV insulated bundle conductor.

The test shall be carried out applying on the insulated bundle conductor a voltage which shall rise (rate-of-rise 1 kV/s) up to 6 kV r.m.s., 50 Hz. The voltage of 6 kV shall be maintained for a period of 1 min under artificial rain conditions according to IEC 60060-1:2010.

The test voltage shall be applied between the insulated bundle conductor and one electrode, positioned wherever on the shunt. Among the different positions of the electrode, one shall be at the end of the shunt over its insulating sleeve and another at the middle of the shunt over its insulation.

The electrodes shall be made of 3 or 4 turns of aluminum conductor 3 mm to 4 mm in diameter. During test the specimen shall be placed at a position which corresponds to its installation conditions on the network.

A number of 3 specimens is taken for this test. For the 3 abovementioned specimens, connector heads of size 1 (25 mm<sup>2</sup>), size 2 (35-70 mm<sup>2</sup>) and size 3 (120 mm<sup>2</sup>) shall be used respectively.

##### 6.1.3. Overheating and overcurrent test

This test shall be carried out according to the paragraph 2.9. of Specification NF C 33-020/94. A



number of 6 specimens will be used for this test. Two of these specimens shall have previously passed the robustness test of paragraph 6.1.1. The test shall be carried out using 2 specimens for size 1 (25 mm<sup>2</sup>) connector head, 2 specimens for size 2 (35-70 mm<sup>2</sup>) connector head and the last 2 specimens for size 3 (120 mm<sup>2</sup>) connector head. The specimens shall be connected to the branch line of connector heads.

#### 6.1.4 Short-circuit current withstand test

To check the technical requirements of paragraph 5.5 of the present description a short circuit test is carried out on the system "connector head-shunt-connector head". Each connector head shall be connected to a piece of LV insulated bundle conductor. A number of 6 specimens is taken for this test. The test shall be carried out using 2 specimens for size 1 (25 mm<sup>2</sup>) connector head, 2 specimens for size 2 (35-70 mm<sup>2</sup>) connector head and the last 2 specimens for size 3 (120 mm<sup>2</sup>) connector head.

After the above test, no part or section of the specimens should be damaged

## 6.2 Sample tests

In every partial delivery an individual and random sample of equipment shall be taken and the following tests shall be carried out. For these tests a simple sampling plan shall be carried out according to the PPC technical description TK 02.01 using special inspection level S4 for normal inspection and acceptable quality level AQL=2,5%.

### 6.2.1. Visual and size check

On each one specimen of the sample, its conformity or declination from the terms of the present description concerning the dimensions and the technical features is checked according paragraphs 5.1, 5.2 and 5.3, 5.4 and 5.7 of the present description (unless otherwise stated).

### 6.2.2 Robustness check

The test of paragraph 6.1.1 of the present description shall be carried out taking into consideration that 10 operations of connection-disconnection shall be carried out on each specimen.

### 6.2.3 Insulating sleeve test

The conformity or deviation of the materials used for the insulating sleeves and for the insulation of the cable, with the materials mentioned in the technical bid of the Seller is checked. This check shall be carried out according to the Standards mentioned in the technical bid of the Seller.

## 7. LABELS - MARKING

A marking with carved or impressed characters (attention for the weakening of insulating sleeve) shall be engraved on the insulating sleeves of the equipment for the name or trademark of the manufacturer and the year of manufacture. The insulation of the single-pole cable shall bear, at each one meter of its length, a marking for the name or trademark of the



manufacturer, the cross-section of Cu conductor in mm<sup>2</sup>, the double triangle symbol as well as the year of manufacture.

Moreover, on the external surface of each case (see paragraph 8) the name or trademark of the manufacturer, the year of manufacture, the label "ΜΟΝΟΠΟΛΙΚΗ ΓΕΦΥΡΑ ΣΥΝΕΣΤΡΑΜΜΕΝΟΥ ΚΑΛΩΔΙΟΥ ΧΤ" and the material code number (M.C.): 4300021979 (in the Greek language) shall be written in indelible characters.

Characters of 6 mm height and 3 mm width at least are required (characters "1" and "I" are excepted).

The following label should be written on two opposite sides of each box in Greek language: "ΑΡΙΘΜΟΣ ΣΥΜΒΑΣΗΣ/ΕΤΟΣ: (Contract Number)/(Year)".

The markings mentioned above must be distinct and indelible (taking into consideration the heavy conditions of outdoor use).

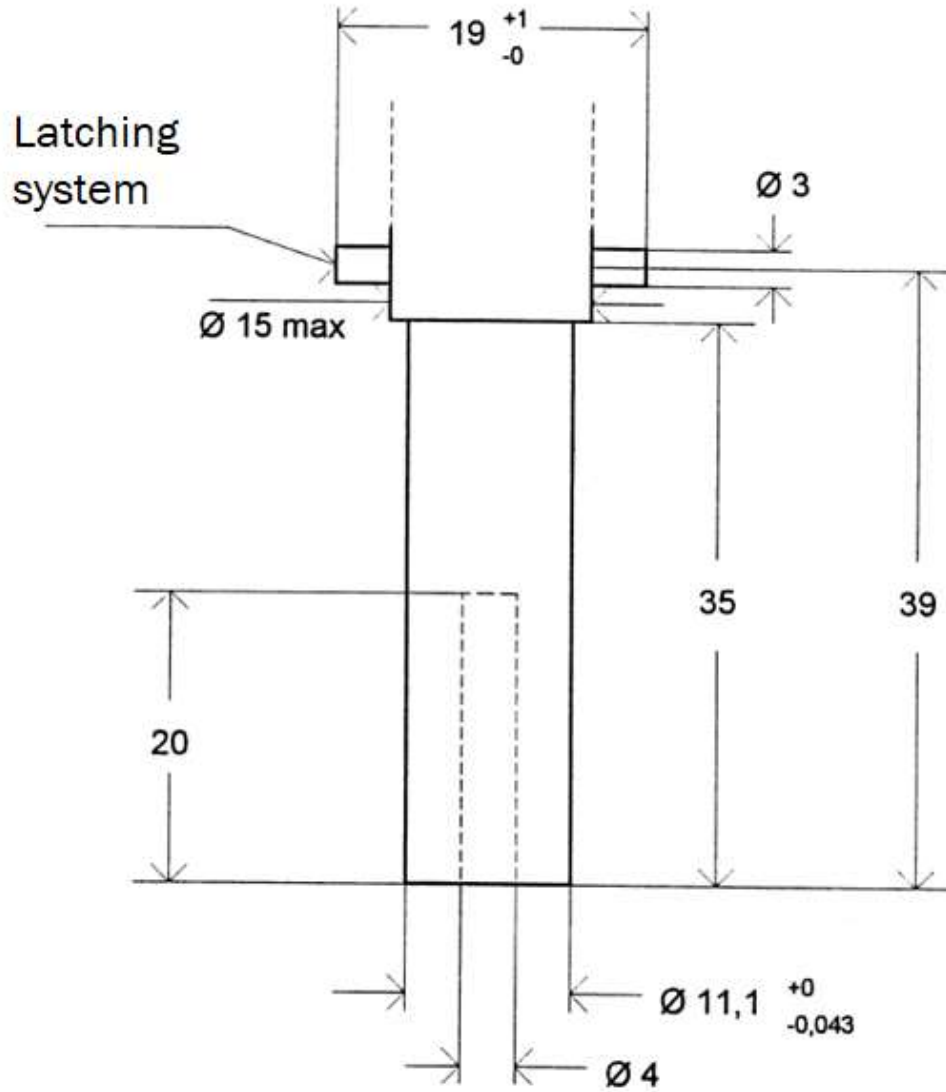
## 8. PACKING

The shunt pieces shall be packed in groups of 5 fully enclosed in a permanent case manufactured of a resistant to the outdoor use material. The case shall have a suitable and durable handle.

For their transportation the cases shall be placed in boxes of suitable strength and safety for transportation and stacking conditions up to 2,5 m high. The weight of these boxes shall not exceed 50 kg.

## 9. ANNEXES - DRAWINGS

- Drawing 1: Connector head plug
- Drawing 2: Socket with its insulating sleeve



Drawing 1: Connector head plug





Drawing 2: Socket with its insulating sleeve